2.2 SAR Transceiver System (STS)

The radar signal flow begins in the Exciter/Receiver Unit (ERU) of the STS. There, expanded range pulses (chirps) are produced by one of two Surface Acoustic Wave (SAW) devices, depending on the chosen mode of range resolution. The chirps, derived from a stable local oscillator (STALO), are up-converted to the C-band transmission frequency, and amplified by a Travelling Wave Tube (TWT). A peak power of over 40 kW is achieved at the output of the transmitter. This signal is passed through a pressurized waveguide to the antenna subsystem and then transmitted by the selected antenna (H or V polarization) over the swath to be imaged. The antenna platform is stabilized in two axes by the antenna positioner, which is controlled by the motion compensation system.

Because of the relatively high average power transmitted (Table I) and low PRF, no pre-summing is required and the data can be processed directly as received. This has direct practical importance in several applications such as ocean wave work where Doppler spectral information needs to be preserved.

Two separate but nominally identical receivers are used to amplify and range compress the like- and cross-polarized radar returns. The Radio Frequency (RF) signals are input to low-noise amplifiers and down-converted using single-sideband mixers and oscillators also locked to the stable oscillator. Range compression is performed using SAWs having inverse functions to the expansion SAWs, and the output signal is separated into in-phase and quadrature (I and Q) components by a video network. Both channels process data simultaneously.

The four video signals (I and Q for channels A and B) are fed to the RTSP, where they are digitized, motion-compensated and one pair is azimuth compressed to produce digital imagery in real time. The dynamic range of the received signals is matched to those of the ADC's (Analogue-to-Digital Converters) by means of STC's in the intermediate frequency amplifiers of both receivers. (See Section 2.4.)

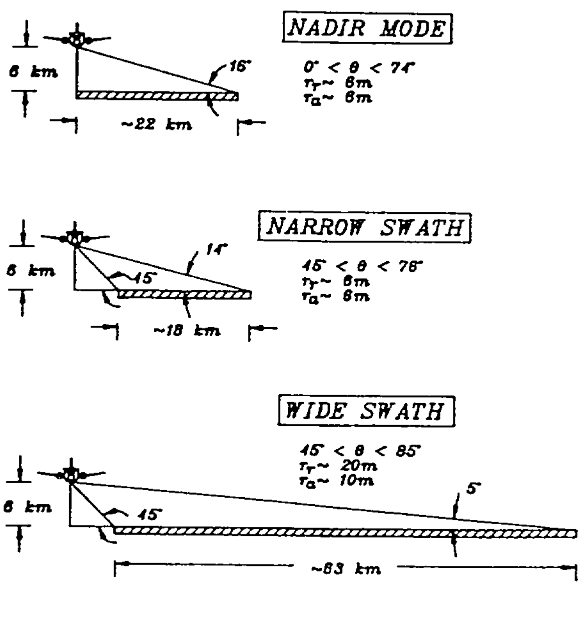

Figure 1: Radar Imaging Modes.
The three imaging modes of the system are shown for a port-looking configuration at a nominal flying altitude of 6000 m (20000 ft). The ground swath imaged is indicated in each case by the cross-hatched portions and the depression angles at the near and far edge of the swath are marked. The table at the side gives the range of incidence angles imaged and the pixel resolution in slant range and azimuth for each mode.

2.3 Radar Control

The radar is controlled by a custom built computer and software system which uses input from feedback measurements, from external peripheral devices (Inertial Reference Unit, Master Clock *etc.*) and operator keyboard entries to generate commands and data base values and to distribute these to the radar modules. All operator entries are stored in non-volatile memory so that only modifications to the current radar configuration need to be entered by the radar operator. Soft screen interactive displays are used to restrict control commands to available, valid choices and to provide operator prompts for required actions. The operator station is shown in Fig. 3.

A complete set of radar and navigation parameters are recorded on computer compatible tape in a peripheral data logging system known as MAID [11,9].

In addition to performing the SAR module control, operator interface and data logging functions, the control computer also performs data routing and self test functions. All radar module control settings are computed for the desired configuration at the start of each data acquisition line. The main control computer also controls the timing of module operations and acts as bus master for control communications and provides powerful signal monitoring capabilities. Self testing is automatically performed for the entire radar on start-up. Operation is constantly monitored for errors, and automated diagnostic tests at a detailed level are also provided. The control system makes extensive use of the signal monitoring capabilities. Data can be sampled from many points in the system, and a variety of test signals can be injected, for example, at the receiver inputs. Real-time signal level calibration and displays are provided which allow the operator to view and adjust the along- and across-track energy profiles. The control system also automatically fine-tunes the antenna pointing within a fraction of a degree.